

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SERVICES DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Project Procedures

TITLE: QA/QC Water and Methane Gas Monitoring at Solid Waste Disposal Facilities

EFFECTIVE DATE: January 30, 2006

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SUMMARY OF REVISIONS: Not applicable, this is a new project procedure.

APPLICABILITY: This project procedure is applicable to all ESP personnel who perform sampling of groundwater and/or methane gas at solid waste disposal facilities.

DISTRIBUTION: MoDNR Intranet
ESP, SOP Coordinator

RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0 SCOPE AND APPLICABILITY

- 1.1 Environmental Services Program (ESP) personnel will monitor landfill facilities for groundwater and/or methane gas as specified by the Solid Waste Management Program (SWMP) in the Quality Assurance Project Plan (QAPP) for “Water Sampling and Methane Gas Monitoring at Solid Waste Disposal Facilities”.
- 1.2 All permitted landfills are required by SWMP to have an approved plan for groundwater and methane gas monitoring. Groundwater sampling is conducted to determine if the landfill is causing any detrimental effects on the groundwater aquifer. Samples are split with the landfill to determine if there is any groundwater contamination and also as a quality assurance check of the sampling techniques and field instruments of the landfill operator and/or contractor. ESP personnel shall observe the purging and sampling techniques of the landfill and collect split-samples for at least one up-gradient and two down-gradient wells.
- 1.3 Methane gas sampling is conducted to determine if any gas is migrating to or across property lines. Methane gas can be an explosion hazard in on-site and off-site buildings. ESP samples the gas wells immediately following the operator and/or contractor to detect the presence and percentage of methane. Split-sampling of the gas wells allows ESP to detect the presence of methane gas and to check the accuracy of the operator’s/contractor’s gas-detecting instrument and sampling methods. At a minimum, ESP shall conduct split-sampling at five gas monitoring wells per landfill or as determined by SWMP.

2.0 HEALTH AND SAFETY REQUIREMENTS

- 2.1 Personnel shall participate in the medical monitoring program in accordance with MDNR’s medical monitoring policy. This policy can be viewed on MDNR’s intranet Health and Safety information page.
- 2.2 Appropriate protective gear such as disposable gloves and work boots with a steel shank and steel toe should be worn by ESP personnel. It is advisable to frequently wash hands with soap and water in addition to wearing disposable gloves.
- 2.3 Personnel shall complete a trip itinerary as part of their trip preparation and notify their supervisor. The itinerary should be updated with the supervisor as necessary.

3.0 PERSONNEL QUALIFICATIONS

Field personnel should be trained in field sample collection procedures, i.e. personnel should have taken a basic sampling workshop, the department-sponsored inspection and enforcement training, and/or been trained by an MDNR employee knowledgeable in the collection of field samples. Personnel should also be familiar with all applicable standard operating procedures.

4.0 SUPPLIES AND EQUIPMENT

4.1 The following supplies and equipment are needed for groundwater QA/QC monitoring:

- pH meter
- conductivity meter
- pocket thermometer
- sample containers (cubitainers, VOA vials, plastic bottles)
- sample labels (numbered and blank)
- Chain-of-Custody Record
- disposable gloves
- cooler(s) and ice
- field notebook/pen
- SWMP QA/QC Water Monitoring Checklist for Solid Waste Disposal Facilities
- Deionized or distilled water (DI water)
- paper towels
- Kim Wipes
- clipboard
- plastic caddy or bucket
- preservatives (HCl, H₃PO₄, HNO₃, H₂SO₄)
- certified standards for pH and conductivity

4.2 The following supplies and equipment are needed for methane gas split-sampling:

- gas detecting instrument (ex: Landtec GA-90, GEM 500, GEM 2000)
- calibration gases (O₂, CO₂, and CH₄)
- field notebook/pen
- SWMP QA/QC Gas Monitoring Checklist for Solid Waste Disposal Facilities
- clipboard

5.0 SAMPLING PREPARATION

5.1 The SWMP QAPP will identify which landfills ESP personnel will sample. The landfills will be assigned to ESP personnel by the Water Quality Monitoring Unit (WQMU) supervisor.

5.2 ESP personnel shall complete a trip itinerary and check out a vehicle prior to the sampling trip.

5.3 Personnel shall notify the appropriate regional office (RO) director via email at least 5 days prior to the date of the sampling trip. The RO director should be informed that ESP personnel intend to monitor a landfill in their region and the following information should be provided:

- Environmental Specialist(s) conducting the sampling
- date of sampling
- landfill to be sampled

5.4 Personnel shall contact the appropriate party associated with the landfill sampling (i.e. landfill operator, contractor) to determine the date and time for the QA/QC audit.

5.5 Personnel shall notify the Chemical Analysis Section (CAS) least five days prior to sample check-in of the following information:

- number of samples
- analyses to be conducted
- date of delivery
- delivery method (hand carried versus delivered)

5.6 Meter checkout and readying of field supplies and other equipment is the responsibility of the Environmental Specialist(s) conducting the survey. The proper containers and preservatives needed for the required sampling should be determined (see MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*).

5.7 A Field Sheet and Chain-of-Custody Record (COC) should be prepared prior to the survey and should accompany the samples from the time of collection until the samples are relinquished to the sample custodian at ESP/CAS (see MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*).

5.8 For convenience, sample labels can be completed (excluding time and date) prior to the survey (see MDNR-FSS-003 *Sample Numbering and Labeling*). The labels should be kept with the COC record until they are attached to the sample containers for collection.

6.0 SAMPLING PROCEDURES

6.1 The Environmental Specialist(s) shall record the appropriate field documentation as follows (see MDNR-FSS-004 *Field Documentation*) in a field notebook:

- date/time of sampling
- participants
- type of sampling/parameters to be analyzed
- weather conditions
- meter calibration information/property numbers
- general comments (e.g. sample color/odor, turbidity, well #, condition of wells, comments on the contractor's methods, etc.)

6.2 Groundwater Monitoring

- 6.2.1 ESP personnel shall calibrate their field instruments (pH and conductivity) according to manufacturer's instructions and check the meters against certified standards. The Environmental Specialist (ES) shall observe the operator/contractor calibrate their field instruments and have the operator/contractor check his/her meters with the certified standard every day of purging and/or sampling. All observations, notes, or data shall be recorded either in the field notebook or on the QA/QC groundwater checklist found in Appendix A.
- 6.2.2 The ES should observe the purging techniques of the operator/contractor and make notes as needed. The ES shall measure field parameters (pH, conductivity, temperature) of the purge water along with the contractor to be sure the well water parameters have stabilized before sampling commences. If more than one type of purging procedure (e.g. bailer, micropurging, etc) is used, the ES should attempt to observe these as well.
- 6.2.3 During split-sampling, ESP shall alternate collecting samples with the contractor/operator. Care should be taken to assure that no sampling equipment or containers come in contact with the ground or other potentially contaminated surfaces.
- 6.2.4 ESP personnel shall complete the questions in the QA/QC groundwater checklist (Appendix A) and review any problems (or areas of concern) with the contractor.

6.3 Methane Gas Monitoring

- 6.3.1 If the GEM 2000 is used, ESP personnel should download the landfill well information provided by SWMP onto the gas reading instrument using the DataField CS software. Well information should include well numbers and well descriptions for each landfill to be sampled by ESP this fiscal year. Well information can also be manually entered into the gas reading instruments (ex. GEM 2000, GA-90, etc.). Refer to the instruments' instruction manual for more detailed information.
- 6.3.2 ESP personnel shall calibrate the gas meter with the appropriate calibration gases either prior to leaving the office or at the landfill away from any of the gas monitoring wells or any potential sources of contamination. The instrument shall be calibrated according to manufacturer's instructions.
- 6.3.3 The ES shall observe the contractor/operator calibrate the gas meter if he/she has not already done so. Some contractors/operators will rent their instrument and rely upon the factory calibration. Make a note of either case in the field notebook.
- 6.3.4 Observations shall be made as the contractor/operator takes gas readings. Notes should be taken as needed. The "QA/QC Landfill Gas Monitoring Checklist" found in Appendix B of this project procedure should be used as a guide for

note taking/observations. The SWMP technical bulletins for landfills may also be used as a reference. These documents can be accessed on the internet.

- 6.3.5 ESP shall take comparative gas readings with their meter. The readings at each well should be at least 90 seconds in length (or until the readings stabilize) and the readings should be saved (on the meter) every 30 seconds. IMPORTANT: Several readings can be stored on the GEM 2000 for each well. The timer on the meter will reset to 90 seconds but you may still store other readings for the same well without risking the loss of previous measurements.
- 6.3.6 ESP personnel shall complete the questions in the QA/QC methane gas checklist and review any problems (or areas of concern) with the contractor.
- 6.3.7 Upon returning to the office, the readings stored in the gas meter should be downloaded using DataField CS or the appropriate software. The readings can be converted to a table format in Excel. The table of readings should be included in the gas monitoring report.

7.0 SAMPLING CONSIDERATIONS

- 7.1 The sample containers should have the appropriate preservatives added immediately following sample collection except for the 40-mL amber vials which are to be pre-preserved. Refer to MDNR-FSS-001 to determine which preservatives are required for the parameters to be analyzed.
- 7.2 The containers shall be placed on ice in a cooler and remain in possession of the sample collector until they are relinquished to the sample custodian at ESP/CAS (See MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to ESP Lab*).
- 7.3 After relinquishing the samples to CAS, a copy of the COC record should be made for the sample collectors record. The COC record should be checked in Sample Master for any errors. If errors are found they should be immediately reported to CAS so that the appropriate changes can be made.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

- 8.1 Collection of duplicate field samples is required on approximately 10 percent of all samples collected for landfill groundwater split-sampling per ESP standard operating procedures. The results of the duplicates will be used by ESP to evaluate the accuracy and precision of field sample collection procedures (see MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*).
- 8.2 Duplicate samples shall be collected in the same manner and order as the true sample.

9.0 COMPLETION AND REPORTING

- 9.1 Upon return from a monitoring trip, all unused supplies should be returned to the appropriate storage areas. All used meters shall be “checked in” and returned to their appropriate storage areas. Any malfunctioning meters shall be reported to the WQMS supervisor.
- 9.2 All groundwater results will be reported by CAS and forwarded to SWMP and the sample collector. Any errors in the results reports should be brought to the attention of CAS so that corrections can be made.
- 9.3 Reports are to be written following any landfill monitoring event. Report templates are found on the “P” drive within the “WQM” folder. The “Discussion” section of the report should be used to discuss the operator’s methods, other observations, and any sampling recommendations by ESP. Using the Document Tracking Database, reports should be forwarded to the appropriate person(s) for review and to be finalized. Chemical analyses results should then be attached to the reports and given to the director of ESP for approval before the report is filed at ESP and sent to SWMP.

10.0 REFERENCES

- MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*
- MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*
- MDNR-FSS-003 *Sample Numbering and Labeling*
- MDNR-FSS-004 *Field Documentation*
- MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to ESP Lab*
- MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*

QA/QC WATER MONITORING CHECKLIST FOR SOLID WASTE DISPOSAL FACILITIES

Facility Name: _____

Permit #: _____ No. of Wells _____

Date of Sampling : _____

Contractor Name _____

Address: _____

Phone Number: _____

Analytical Lab Name: _____

Address: _____

Phone Number: _____

Participants:

Name

Position Title

Facility: _____

State Lab: _____

Contractor: _____

YES/NO

I. General Review of Monitoring Well Sample Collection Procedures

A. Sampling Frequency/Guidelines

1. How often are monitoring wells sampled? _____
2. Is the contractor familiar with the guidelines found in the SWMP technical bulletin "Collection, Handling and Reporting Procedures for Groundwater Samples"? ☐ ☐

B. Monitoring Well Location and Security

1. Does the contractor have a map of the facility available to locate wells? ☐ ☐
2. Are the wells clearly marked with an identification numbering system? ☐ ☐
3. Are monitoring well heads covered with protective caps? ☐ ☐
4. Are the caps locked to prevent unauthorized access? ☐ ☐
5. Describe the overall condition of the wells. _____

C. Measurement of Well Depths

1. What type/brand of measuring device is used? _____

2. Is there a permanent depth measurement reference point at each well? ☐ ☐
3. Are measurements taken to the nearest inch or 0.1 foot? ☐ ☐
4. Does the contractor measure both the depth to standing water and depth to the bottom of the well? ☐ ☐
5. Describe the method and materials used to clean the measuring device. _____

YES/NO

D. Well Evacuation/Sample Collection

1. Were measures taken to prevent equipment from contacting potentially contaminated surfaces? ☐ ☐

2. What method (ex: micropurging) is used to evacuate/sample the wells?

3. Describe the type(s) of equipment used to evacuate/sample the wells.

4. Describe the method used to calculate one well volume. _____

5. Is the volume of evacuated well water measured? ☐ ☐

6. Are wells evacuated according to the guidelines found in Section C2 of the SWMP technical bulletin "Collection, Handling and Reporting Procedures for Groundwater Samples"? ☐ ☐

7. Describe the procedure used for the collection, management, and/or disposal of evacuated water. _____

8. Does each well have dedicated evacuation equipment? ☐ ☐

If no, describe materials and methods used to clean equipment in Section VI.

E. Sample Collection

1. Does each well have dedicated/disposable sampling equipment? ☐ ☐
If no, describe materials and methods used to clean equipment in Section VI.

2. Are equipment blanks, duplicate samples, and/or trip blanks collected as necessary? ☐ ☐

YES/NO

3. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to sample collection? ☐ ☐
4. Are samples collected in a manner that will minimize aeration and/or volatilization of the sample? ☐ ☐
5. Are upgradient wells sampled first? ☐ ☐
6. Describe the procedure used when splitting samples with the state.

II. General Review of Surface Point Sample Collection Procedures

- A. Are surface points sampled? If no, proceed to section III. ☐ ☐
 1. Is contractor familiar with the SWMP guidelines? Refer to SWMP technical bulletin "Collection, Handling and Reporting Procedures for Groundwater Samples" (Section B). ☐ ☐
- B. Surface Point Location and Description
 1. Is a map available to locate sampling points and are the sampling points marked? ☐ ☐
 2. Are water level conditions and/or stream flow conditions noted? ☐ ☐
- C. Sample Collection
 1. Is dedicated sampling equipment used to sample surface points? ☐ ☐
 2. Are equipment blanks, duplicate samples, and/or trip blanks collected as necessary? ☐ ☐
 3. Describe the equipment used to collect surface water samples. _____

 4. Is care taken to avoid placing clean sampling equipment on the ground, or otherwise contaminating equipment prior to collection? ☐ ☐

YES/NO

III. Review of Field Measurements, Sample Handling and Preservation Procedures

A. Field Measurements

1. Are the following parameters measured in the field?
pH? ☐ ☐
Temperature? ☐ ☐
Specific Conductivity? ☐ ☐
Turbidity? ☐ ☐
2. Are field meters properly calibrated and maintained? ☐ ☐
3. Are field measurements within the acceptable limits of the certified standard? ☐ ☐
4. Are field measurements made using a split portion of sample rather than in a container to be analyzed by the lab? ☐ ☐
5. Describe the equipment used for field measurements (type,model,etc).
pH _____
Temperature _____
Conductivity _____
Turbidity _____

B. Sample Containers

1. Are sample containers new? If not, explain in Section VI. ☐ ☐
2. Are sample containers appropriate for each parameter? ☐ ☐

C. Sample Handling and Preservation

1. Are samples directly transferred from the sampling device to the sample container? ☐ ☐
2. Are samples containerized in order of their volatilization sensitivity? (VOA, TOC, field measurements, metals, COD, chloride, NFR) ☐ ☐
3. Are samples preserved appropriately for each parameter? ☐ ☐
4. Is a trip blank prepared for the VOA/TOC samples? ☐ ☐
5. Was the headspace eliminated from the VOA containers? ☐ ☐
6. Are samples put on ice immediately after collection? ☐ ☐

YES/NO

7. How long are samples in route to the analytical lab? _____

IV. Review of Field Documentation and Sample Chain-of-Custody Procedures

A. Sample Documentation

1. Are sample labels used? ☐ ☐

2. Do they remain attached and legible even when wet? ☐ ☐

3. Is the following information provided on the label?

Sample number? ☐ ☐

Well number? ☐ ☐

Name of collector? ☐ ☐

Date and time of collection? ☐ ☐

Facility name? ☐ ☐

Parameters to be analyzed? ☐ ☐

Preservative used? ☐ ☐

B. Site Information

1. Is field information recorded by the contractor? ☐ ☐

2. Which of the following are recorded?

Time and date of sampling and evacuation? ☐ ☐

Weather conditions at time of sampling? ☐ ☐

Well identification number? ☐ ☐

Total depth of wells? ☐ ☐

Static water level depth? ☐ ☐

YES/NO

Well yield-high or low? ☐ ☐

Well sampling sequence? ☐ ☐

Field measurements data? ☐ ☐

Field team members? ☐ ☐

Additional observations? ☐ ☐

C. Chain of Custody Records

1. Is each sample recorded on a chain-of-custody? ☐ ☐

2. What information is included on the chain-of-custody? _____

V. Certified Standard Results

Parameter	Contractor Results	True Value	Acceptable limits/Lot number
pH (units)			
Conductivity (uS/cm)			

[illegible]

**QA/QC LANDFILL GAS MONITORING CHECKLIST
FOR SOLID WASTE DISPOSAL FACILITIES**

Facility Name: _____

Permit #: _____ No. of Wells _____

Date of Sampling : _____

Contractor Name _____

Address: _____

Phone Number _____

Analytical Lab Name: _____

Address: _____

Phone Number _____

Participants:

Name

Position Title

Facility: _____

State Lab: _____

Contractor: _____

YES/NO

I. General Review

- A. Is the sampler familiar with the guidelines found in the SWMP technical bulletin "Sampling of Landfill Gas Monitoring Wells"? ☐ ☐
- B. Monitoring Well Location and Security
1. Does the contractor have a map of the facility showing the gas wells? ☐ ☐
2. Are monitoring wells covered with locked, protective caps? ☐ ☐
3. Are the gas wells clearly marked with an identification numbering system? ☐ ☐
- C. Condition of Gas Wells
1. Are inner gas well casings sealed with airtight caps? ☐ ☐
2. Are there any obvious signs of leaks around the caps? ☐ ☐
3. Are the gas wells easily accessible (i.e. no overgrowth of vegetation)? ☐ ☐

II. Gas Monitoring Well Procedures

- A. How often are gas monitoring wells sampled? _____
- B. What type of instrument is used to test for gas in wells? _____
- C. Does the instrument detect methane in an oxygen deficient environment? ☐ ☐
- D. Does the instrument detect the following?
- | | | |
|------------------|--------------------------|--------------------------|
| Methane? | <input type="checkbox"/> | <input type="checkbox"/> |
| Oxygen? | <input type="checkbox"/> | <input type="checkbox"/> |
| Carbon Dioxide? | <input type="checkbox"/> | <input type="checkbox"/> |
| Explosive Gases? | <input type="checkbox"/> | <input type="checkbox"/> |
- E. Is the meter checked to be sure it is functioning correctly by checking a known concentration of gas ? ☐ ☐

YES/NO

- F. When was the instrument last calibrated? How often is the instrument calibrated? _____

- G. Is the instrument zeroed before each well measurement? ☐ ☐
- H. How long is each well tested? _____

III. Building Monitoring Procedures

- A. Are buildings tested? If no, go to section IV. ☐ ☐
- B. What type of instrument is used to test in buildings? _____

- C. How often is the instrument calibrated or checked to be sure it is functioning properly? _____

- D. Does the instrument detect the following gases?
- | | | |
|------------------|--------------------------|--------------------------|
| Methane? | <input type="checkbox"/> | <input type="checkbox"/> |
| Oxygen? | <input type="checkbox"/> | <input type="checkbox"/> |
| Carbon Dioxide? | <input type="checkbox"/> | <input type="checkbox"/> |
| Explosive Gases? | <input type="checkbox"/> | <input type="checkbox"/> |
- E. When was the instrument last calibrated? _____

- F. How long does the sampler allow the instrument to test before recording a reading? _____
- G. Describe the procedure (including locations) for testing in buildings. _____

IV. Field Documentation

- A. Is sampling information recorded in a logbook, notebook, etc? ☐ ☐

YES/NO

1. Are the following recorded:

General Weather Conditions? ☐ ☐

Precipitation Amounts? ☐ ☐

Temperature? ☐ ☐

Soil Conditions? ☐ ☐

Barometric Pressure? ☐ ☐

Gas Well Conditions? ☐ ☐

Gas Well Readings? ☐ ☐

Type of Sampling Equipment? ☐ ☐

Name of Sampler? ☐ ☐

Unusual Conditions/Other Comments? ☐ ☐

V. Response Procedures

A. Are there written procedures for dealing with methane exceedances? ☐ ☐

B. Have there been any exceedances in the past? ☐ ☐

[illegible]